REMARKS

Claims 1-19 and 21-25 are currently pending in this application. Claim 22 has been withdrawn from consideration as being directed to a non-elected species of invention. By way of this Reply, independent claims 1, 21, and 23 have been amended, without prejudice, and independent claims 24 and 25 have been added to further define the claimed invention. Applicants submit that no new matter has been introduced into the application by these amendments.

Information Disclosure Statement

The Examiner did not consider the German Patents Nos. DE 195 31 466 and DE 198 52 833 cited in the Supplemental Information Disclosure Statement (SIDS) filed on March 22, 2007. The Office Action states that because these patents are in a foreign language, a concise explanation of their relevance is required. With respect to DE 198 52 833, enclosed is a copy of the counterpart U.S. Patent No. 6,703,614. With respect to DE 195 31 466, enclosed is a copy of the English abstract from the counterpart International Publication WO 96/30717.

The Examiner also did not consider the *Optical Memory & Neural Networks* (Oshikane et al.) reference cited in the March 22, 2007 SIDS because it did not include a complete copy of the article. Applicants became aware of this reference when it was provided in a Search Report in Applicants' co-pending application GB Patent Appln. No. 0124948.1; however, the British Patent Office only provided the two page Abstract submitted in the March 22, 2007 SIDS. After reasonable search,

Applicants are unable to locate a full copy of this publication, and respectfully request that the Examiner enter the Abstract of this publication previously provided with the March 22, 2007 SIDS..

Claim Rejections – 35 U.S.C. § 112, second paragraph

Claims 1-19, 21 and 23 have been rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. In particular, the Office Action states that the application fails to disclose an embodiment which supports the claim language "each scan line compris[es] a plurality of readings." Claims 1-19, 21 and 23 were also rejected under 35 U.S.C. § 112, second paragraph, as being indefinite because "it is unclear what it means for each scan line to comprise a plurality of readings."

By way of this Reply, independent claims 1, 21, and 23 have been amended to delete the phrase "a plurality of readings." Based on these amendments, Applicants respectfully submit that the foregoing written description and indefiniteness rejections should be withdrawn.

Claim Rejections – 35 U.S.C. § 102(b)

Claims 21 and 23 remain rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,254,854 (Betzig). With respect to the rejection of claims 21 and 23, the Office Action states, in pertinent part:

> Betzig discloses a scanning probe microscope and method for scanning a sample by means of interaction between the sample and probe, ... the microscope is arranged, in operation, to carry out a scan of the sample

> surface wherein scan area is covered by an arrangement of scan lines (see generally Fig. 8), each scan line (not shown) provided by laterally oscillating (see col. 3, lines 10-12) either the probe or the sample near resonant frequency (see col. 3, lines 25-30). The oscillation amplitude inherently determines a maximum scan line length.

See Office Action at pg. 4. In response to Applicants prior arguments, the Office Action further clarifies that element 170 shown in Fig. 8 is not a scan line; rather, element 170 is part of the raster scan. See Office Action at pg. 9. Furthermore, the Office Action states, "Applicant fails to appreciate the fact that during the raster scan of Betzig, the probe also dithers (oscillates) in a direction (160) orthogonal to the raster scan. This dithering at resonant frequency is what the Examiner has interpreted as the claimed scan lines." See Office Action at pg. 9. Applicants respectfully traverse the stated grounds for rejection.

As explained in the Declaration of Andrew David Laver Humphis filed on January 31, 2007 ("Humphris Declaration), the term "scan line" recited in the present claims is used in accordance with its recognized meaning in the field of microscopy to refer to a line or linear path, which may be curved or straight, across a sample that is followed by a probe as it gathers information relating to the sample and directly relates to a corresponding line or linear portion of the image. Humphris Declaration at ¶ 13, 16. Thus, the conformation and orientation of the scan line will have a corresponding conformation and orientation in the image.

The Office Action states that the Humphris Declaration "is insufficient to overcome the rejection of the claims ... because the declaration wrongly interprets

the Examiner's rejection." However, as set forth above, the Humphris Declaration seeks to explain the well-accepted meaning of the term "scan line" within the field of microscopy, and as demonstrated below, is highly relevant to the application of the cited prior art in the Office Action. Thus, Applicant's respectfully request that the Examiner reconsider the contents of the Humphris Declaration.

Betzig does not teach or suggest a "scan line," as that term is understood in the field of microscopy and used in the present application. The probe described in Betzig traces two different paths over the sample: (1) a first illustrated by element 170; and (2) a second illustrated by element 160. Pursuant to the April 24, 2007 Office Action, element 170 in Betzig is not considered to be a scan line. Office Action at pg. 9. Applicants respectfully submit that element 160 cannot be a "scan line" because it does not relate to a line or linear path (curved or straight) across a sample that is followed by a probe as it gathers information relating to the sample and which is directly related to a corresponding linear portion of the image as taught by the present invention.

Betzig teaches that the dither motion 160 is "used for shear-force sensing." Betzig at col. 5, lines 49 – 50. This is based on fact that "if the probe is oscillated at a frequency which is near resonance, shear forces will shift the resonance either closer to, or further from, the driving frequency. As a result, the oscillatory amplitude of the probe tip will increase or decrease, respectively." Betzig at col. 3, lines 27-31. Thus, it is the amplitude of probe oscillation that is monitored in

Betzig, and any information derived from this motion is not used to form a linear portion of the image. Rather, "changes in the oscillation of the probe tip" are detected (Betzig at col. 2, lines 29 - 30), which results in a single value obtained for at least a pair of dither oscillations (for a change to be detected). Thus, it should be evident that this single value is not a linear portion of the image; it is a point or pixel in the image.

In response to the teachings set forth in the Humphris Declaration, the Office Action states "it is unclear where in Betzig it states that only a single pixel is read." In response to this statement, Applicants refers to col. 5, lines 58 – 60, of Betzig, which state that the dither frequency should be "greater than the pixel frequency of the NSOM scan." The pixel frequency is the number of pixels scanned per second or, alternatively, the inverse of the time taken to image a pixel. If the dither frequency is higher than this, it follows that the time period for the dither oscillation is less than that taken to image a pixel. Accordingly the dither line must inevitably scan less than a single pixel.

Furthermore, specific values can be obtained from the example described at col. 9, line 18 – col. 10, line 53. The particulars of a raster scan are given at col. 10, lines 49 – 53, which states, "[a]t a typical scan speed, a 256 x 256 pixel [= 65,536 pixels] image was scanned in 15 seconds over a 0.8 μm x 0.8 μm field." This gives a pixel rate of 4.4 kHz, and a pixel size of approximately 3 nm (256 pixels span 0.8 nm in the image). At col. 10, lines 31-32, a typical resonance frequency (of the dither) is

stated to be about 80 kHz, which is an order of magnitude larger than the pixel rate. At col. 10, lines 32-33, the dither amplitude is stated to be about 50Å, which is of similar size to a single pixel.

In summary, the dither line (160) in Betzig does not extend over multiple pixels and its function in the scan is not to form a corresponding line or linear part of the image. Thus, its motion cannot be interpreted as comprising a scan line, which, as explained in the Humphris Declaration, must comprise a collection of separate readings taken along a line which are used to build up an image of the sample.

Accordingly, claims 21 and 23 are distinguishable from Betzig and withdrawal of the anticipation rejections of these claims is respectfully requested.

Claim Rejections – 35 U.S.C. § 103(a)

*1. **Betzig in view of Elings et al.***

Claims 1, 3, and 12-18 remain rejected under 35 U.S.C. § 103(a) as being obvious over Betzig in view of U.S. Patent No. 6,008,489 (Elings et al.). In support of these rejections, the Office Action applied Betzig for the reasons set forth above with respect to claims 21 and 23. See Office Action at pg. 5. Noting that Betzig fails to disclose "responding to a variation in an average value of the at least one parameter," the Office Action further applied Elings asserting that it teaches "averaging values." See Office Action at pg. 5.

Similar to claims 21 and 23, independent claim 1 of the present invention recites, in pertinent part:

> the microscope (10, 50) is arranged, in operation, to carry out a scan of the sample surface wherein a scan area is covered by an arrangement of scan lines, each scan line being provided by laterally oscillating either the probe (20, 54) or the sample (12) at or near its resonant frequency such that oscillation amplitude directly determines maximum scan line length and the arrangement of scan lines is provided by operation of the driving means (16, 22).

As set forth in detail above, Betzig fails to teach or suggest a "scan line" as the term is understood in the microscopy field and recited in claim 1 of the present invention. Thus, Applicants respectfully submit that Betzig is distinguishable from independent claim 1 for the same reasons set forth in detail above with respect to claims 21 and 23. Furthermore, Elings does not resolve the above-noted shortcomings of Betzig.

Accordingly, withdrawal of the obviousness rejection of independent claim 1 is respectfully requested. In addition, claims 3 and 12-18, which depend from claim independent claim 1 are distinguishable from the cited prior art for the same reasons.

2. Kley in view of Betzig and Elings

Claims 1-4, 6-19, and 21 remain rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,752,008 (Kley) in view of Betzig and Elings. Claim 5 remains rejected under 35 U.S.C. § 103(a) as being unpatentable over Kley

in view of Betzig and Elings and further in view of U.S. Patent No. 6,614,227 (Ookubo). In support of these rejections, the Office Action states, in pertinent part:

> Kley discloses a scanning probe microscope and method for scanning a sample by means of interaction between the sample and probe, ... the microscope is arranged, in operation, to carry out a scan of the sample surface wherein scan area is covered by an arrangement of scan lines (see Fig. 8), each scan line provided by laterally oscillating either the probe or the sample at frequency. The oscillation amplitude inherently (see Fig. 3) determines a maximum scan line length. ... Kley does not specifically disclose a feedback mechanism or oscillating at or near a resonant frequency. Betzig teaches (see col. 3, lines 25-30 and col. 5, lines 35-50) oscillating a resonant frequency and providing feedback as claimed.

See Office Action at pgs. 6-7. Applicants respectfully traverse these rejections for the reasons set forth in detail below.

As discussed at length in Applicant's prior responses, Kley does not suggest or disclose that a "scan line," as that term is understood in the field of microscopy to refer to a line or linear path, which may be curved or straight, across a sample that is followed by a probe as it gathers information relating to the sample and directly relates to a corresponding line or linear portion of the image. Furthermore, Kley does not suggest or disclose that each scan line is collected by oscillating a probe at resonance or that each scan line has a maximum length determined by oscillation amplitude as recited in independent claims 1 and 21 of the present invention. As stated in Applicants' prior responses, the vertical oscillations in Kley are carried out to take a single measurement, and once that measurement has been recorded, the probe in Kley is moved/translated by the X-Y and Z translation stages to a new

position where a new reading would be taken by vertically oscillating the probe about the new measurement position. Thus, there is no teaching or suggestion in Kley of a "scan line" which comprises a collection of separate readings taken along a line which are used to build up an image of the sample, as that term is understood in the art.

The Office Action incorrectly assumes that the Humphris Declaration "concede that Kley discloses scan lines having a plurality of readings." Office Action at pg. 10. It is respectfully submitted that this is a misinterpretation of the Humphris Declaration as this is not conceded in any portion of that Declaration and is contrary to the arguments set forth at pages 18-20 of Applicant's January 31, 2007 Reply.

Accordingly, withdrawal of the obviousness rejection of independent claims 1 and 21 is respectfully requested. In addition, claim 2-4 and 6-19, which depend from claim independent claim 1 are distinguishable from the cited prior art for the same reasons.

New Claim 24

New independent claim 24 recites, in pertinent part, that the microscope of the present invention is arranged to form an image corresponding to variations of the measured parameter along each scan line. Support for this limitation can be at pages 3-4 of the specification, as filed, which states:

> Each scan line is collected as a continuous (analogue) image as either the probe oscillates across the surface of the sample or the surface oscillates beneath the probe. ... scan line information can be collected and reconstituted with appropriate displacements to form an image of the two-dimensional scan area. ... Variations in the measured parameter within the timescale of an oscillation therefore constitute the "interaction" image, and are interpreted as arising from true surface features.

Thus, there can be no image interpretation if one oscillation does not encompass spatial variations of the measured parameter, which can be used to construct the image.

For the reasons forth above, the dither line 160 disclosed in Betzig is not used to form an image corresponding to variations in a parameter that are measured along it. Rather, the dither motion 160 is "used for shear-force sensing." See Betzig at col. 5, lines 49-50. This is based on the fact that the "if the probe is oscillated at a frequency which is near resonance, shear forces will shift the resonance either closer to, or further from, the driving frequency. As a result, the oscillatory amplitude of the probe tip will increase or decrease, respectively." See Betzig at col. 3, lines 27-31. Thus, it is clear that the amplitude of probe oscillation is monitored. It is not possible for this to vary and for any variations to be monitored during an oscillation. That is, the probe must complete at least one sweep (or dither line) before amplitude can be determined. It is therefore impossible to measure variations in this parameter along the dither line, and the dither line cannot be a line along which the sample is imaged.

Thus, new claim 24 of the present invention is distinguishable from Betzig. Furthermore, neither Kley, Elings, nor Ookubu teach or suggest the above features recited in new claim 24.

New Claim 25

New independent claim 25 recites, in pertinent part, that the microscope carries out a raster scan of the sample surface, wherein each scan line is a component of the raster scan. Support for this amendment can be found in the Specification at pg. 10, line 8 – pg. 11, line 2; pg. 16, lines 19-22; and pg. 20, line 28 – pg. 21, line 1.

In response to Applicant's previous arguments, the Office Action states, "[e]lement 170 is part of the raster scan ... during the raster scan of Betzig the probe also dithers (oscillates) in a direction (160) orthogonal to the raster scan." Office Action at pg. 10. Therefore, regardless of whether the dither line (element 160) can be considered a scan line or not, it is not part of the raster scan. Accordingly, independent claim 25 states that Applicant's scan line is a component of the raster scan.

The scan line in claim 25 is clearly recited as being a component of a raster scan. As stated by the examiner, the dither line (160) is in a direction orthogonal to the raster scan and so cannot be a component of the raster scan.

Thus, new claim 25 of the present invention is distinguishable from Betzig. Furthermore, neither Kley, Elings, nor Ookubu teach or suggest the above features recited in new claim 25.

Conclusion

If the Examiner believes that any additional minor formal matters need to be addressed in order to place this application in condition for allowance, or that a telephone interview will help to materially advance the prosecution of this application, the Examiner is invited to contact the undersigned by telephone at the Examiner's convenience.

In view of the foregoing remarks, Applicants respectfully submit that the present application, including claims 1-19 and 21-25, is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

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